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TITLE: Prosthetic joint with diamond coated interfaces

Brief Summary Text (4):

The primary problem with prosthetic joints is that the joints eventually erode and must be replaced. This erosion is caused, in large part, by the forces of impact and friction routinely encountered by the load-bearing surfaces of the prosthetic joint. As the joint is repeatedly used, the ball and socket (in the case of a hip prosthesis) wear against each other. The impact and friction forces eventually cause pieces of the load-bearing surfaces to spall and float about the joint. This debris initiates a hystiocytic reaction in which the body's immune system is activated and releases enzymes to dissolve the particles. However, because the debris is usually relatively hard material, such as metal or polycarbon compounds, the enzymes usually fail to dissolve the debris, or take a considerable amount of time to do so. To further complicate matters, the enzymes react with the bone supporting the prosthetic joint. The enzymes weaken or dissolve the bone. This condition causes osteolysis or weakening of the bone, therefor weakening attachment to the bone and making it difficult to replace the prosthetic joint when the bearing surfaces have eroded to such a point that the joint should be replaced. Osteolysis decreases the lifetime of the replacement prosthetic joint, and eventually renders the bone unusable.

Detailed Description Text (6):

FIGS. 2 and 2A illustrate one embodiment of the present invention. FIG. 2 shows diamond-coated load-bearing surfaces forming a joint 104. The joint 104 shown includes a ball 108, stem 112, a fragmented view of the anchor 116 and a socket 130 similar to those shown in FIG. 1. In accordance with the principles of the present invention, the socket 130 and the ball 108 may still be made of durable metal. For example, the ball 108 and socket 130 could be made of titanium, cobalt-chrome alloys, or stainless steel. Such materials are well known in the prosthetic joint art, and have long been considered safe for such purposes. Those skilled in the art will also be able to apply the principles of the present invention to other hard materials such as polycarbon compounds, which may be used in prosthetic joints.

Detailed Description Text (8):

The diamond layers 150 and 158 are typically formed by bonding diamond compact to the load-bearing surface (146 or 136) by sintering at high temperature and high pressure, high temperature laser application, electroplating, chemical vapor deposition, forming a matrix with high molecular weight polyethylene or by other methods which are known in the art. Once the diamond layers 150 and 158 have been applied to the ball 108 and/or socket 130, the diamond surface is polished to a Ra value between 0.10 and 0.01 microns. The friction, and consequently the wear between surface layers 150 and 158, is extremely low, thereby increasing the life of the diamond-diamond joint 104 beyond that of the present art.

Detailed Description Text (12):

It has long been known that polycrystalline materials can be bonded to substrates, such as cemented tungsten carbide and used on rock bits for oil and natural gas. The polycrystalline material is typically bonded to the substrate at pressures in excess of 50,000 atmospheres and temperatures in excess of 1,300.degree. C. For more detailed descriptions of methods of applying polycrystalline compacts to a substrate, see U.S. Pat. Nos. 3,745,623; 3,767,371; 3,871,840; 3,841,852; 3,913,280; and 4,311,490.

CLAIMS:

1. A method of making a prosthetic joint having load-bearing surfaces which interact to enable rotation of one of the load-bearing surfaces relative to the other, the method comprising the steps of:

(a) coating at least one of the load-bearing surfaces with a polycrystalline diamond compact; and

(b) bonding the compact to said diamond-coated load-bearing surface to form a diamond layer over said diamond-coated load-bearing surface;

wherein step (b) comprises bonding a compact to a first of the load-bearing surfaces by using one of the group of processes consisting of a sintering process under high pressure and high temperature, a high temperature laser, chemical vapor deposition, electroplating and forming a matrix of high molecular weight polyethylene.